iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.69533

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

Enhancing Image Deblurring with Advanced Learning

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Abstract: This study presents a novel framework for adaptive photo restoration by integrating GFPGAN for face-focused enhancement and Real-ESRGAN for general image refinement. Users select modes tailored to image content. The model features blur-aware preprocessing, intelligent background boosting, and output evaluation through SSIM. The application is deployed using a user-friendly Gradio interface and shows consistent performance across varied visuals.

I. INTRODUCTION

Recent innovations in neural networks have revolutionized the way degraded visuals are enhanced. Traditional models operate on single use cases. Our architecture bridges this gap by intelligently routing images through models that specialize in either facial clarity or broad scene enhancement.

II. LITERARURE SURVEY

Wang et al. (2021) implemented Real-ESRGAN to reconstruct fine textures in natural scenes. GFPGAN tackled real-world facial degradation challenges.

Lim et al. (2017) proposed a residual learning approach for resolution boosting. Isola et al. explored translation models for visual domain shifts.

III. EXISTING SYSTEM

Current approaches apply a fixed enhancement model, often failing when input complexity varies. Tools lack preprocessing intelligence, model fallback, and don't adapt enhancement logic.

IV. PROPOSED SYSTEM

We developed a two-mode enhancement app. Users select the image type. The system applies pre-enhancement filtering based on clarity. Facial images use GFPGAN, while Real-ESRGAN handles landscapes. Mask-based enhancement isolates regions to avoid distortion.

V. IMPLEMENTATION

Using Python and libraries like OpenCV, NumPy, and Gradio, the models were integrated into an interface that guides image flow from input to result visualization. The models include pretrained GFPGAN v1.3 and Real-ESRGAN Anime x4.

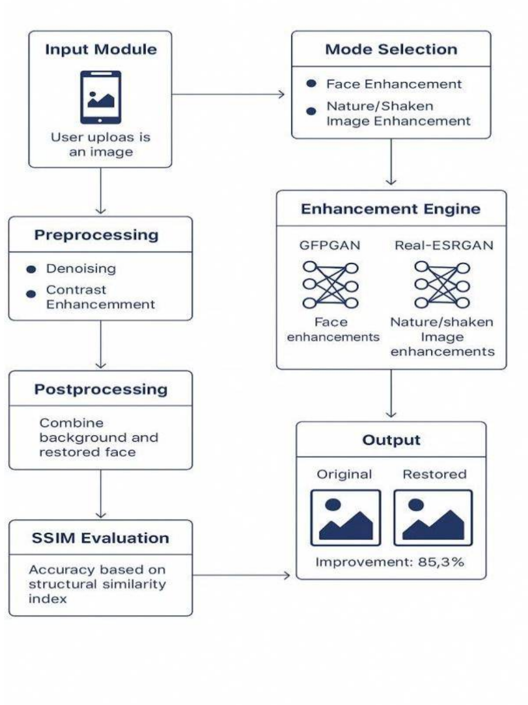
VI. MODULES

Image Uploader → Mode Selector → Smart Preprocessor → Enhancement Core
(GFPGAN/ESRGAN) → Optional Masking → Result Generator → SSIM Evaluator.

VII. ALGORITHMS

Custom logic calculates blur via Laplacian variance. LAB space is used for contrast tuning. GAN models generate refined outputs. SSIM provides restoration feedback.

VIII. SYSTEM ARCHITECTURE



IX. RESULTANDANALYSIS

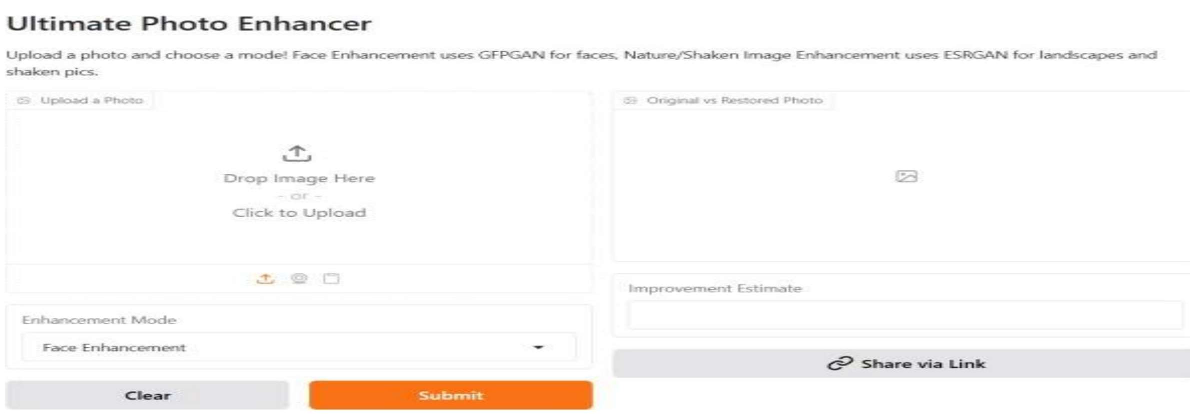


Fig1. Opening Interface

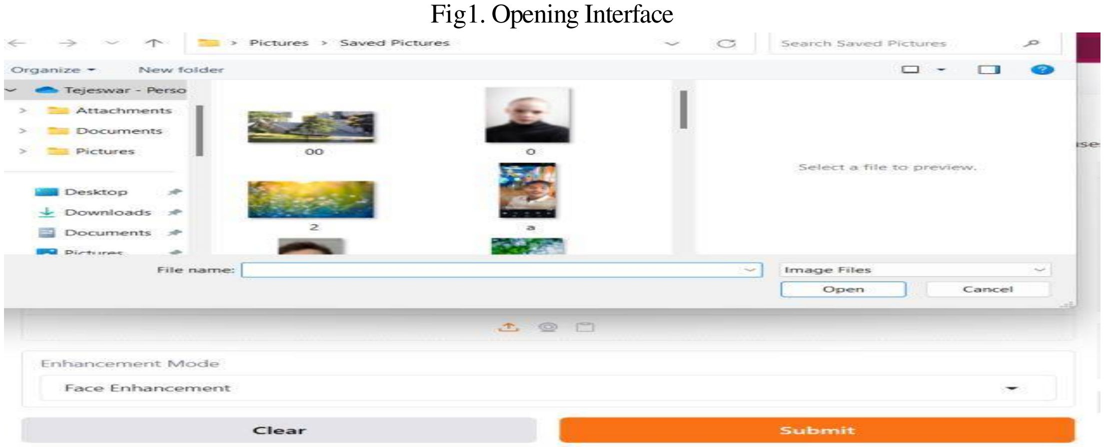


Fig2.openingafile

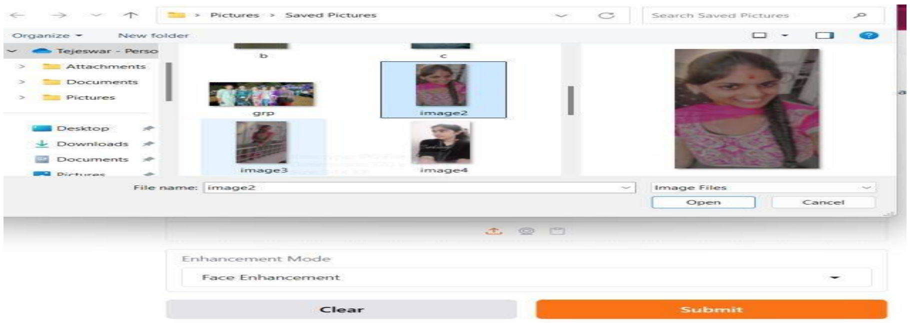


Fig3.selectingan image

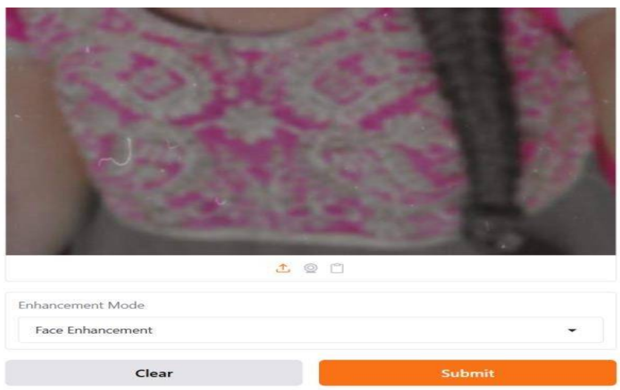


Fig4.selectingenhancementmode

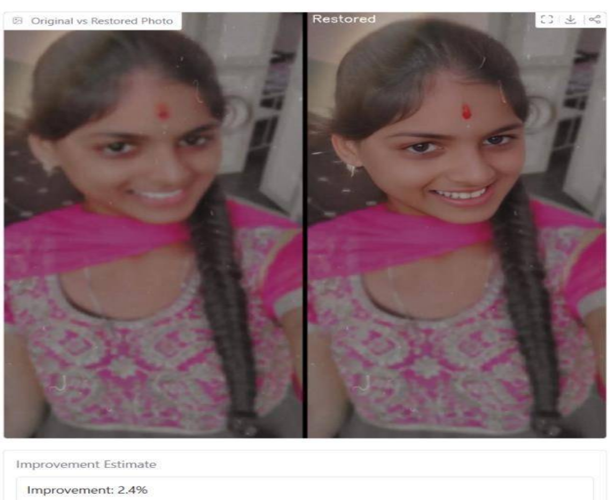


Fig5.OriginalimagevsRestoredimage Fig6.OriginalimagevsRestoredimagefor Nature or Shaken imagefor Face Enhancement

Visual results show marked improvement in detail clarity. Restoration improvements were evaluated using SSIM and user feedback.

X. CONCLUSION

A modular photo enhancement system was created by combining two specialized Generative AI models. This platform achieves accurate and high-quality restoration for various image types.

XI. FUTURE SCOPE

Automation in mode selection, mobile deployment, and multilingual UI support are planned for broader accessibility.

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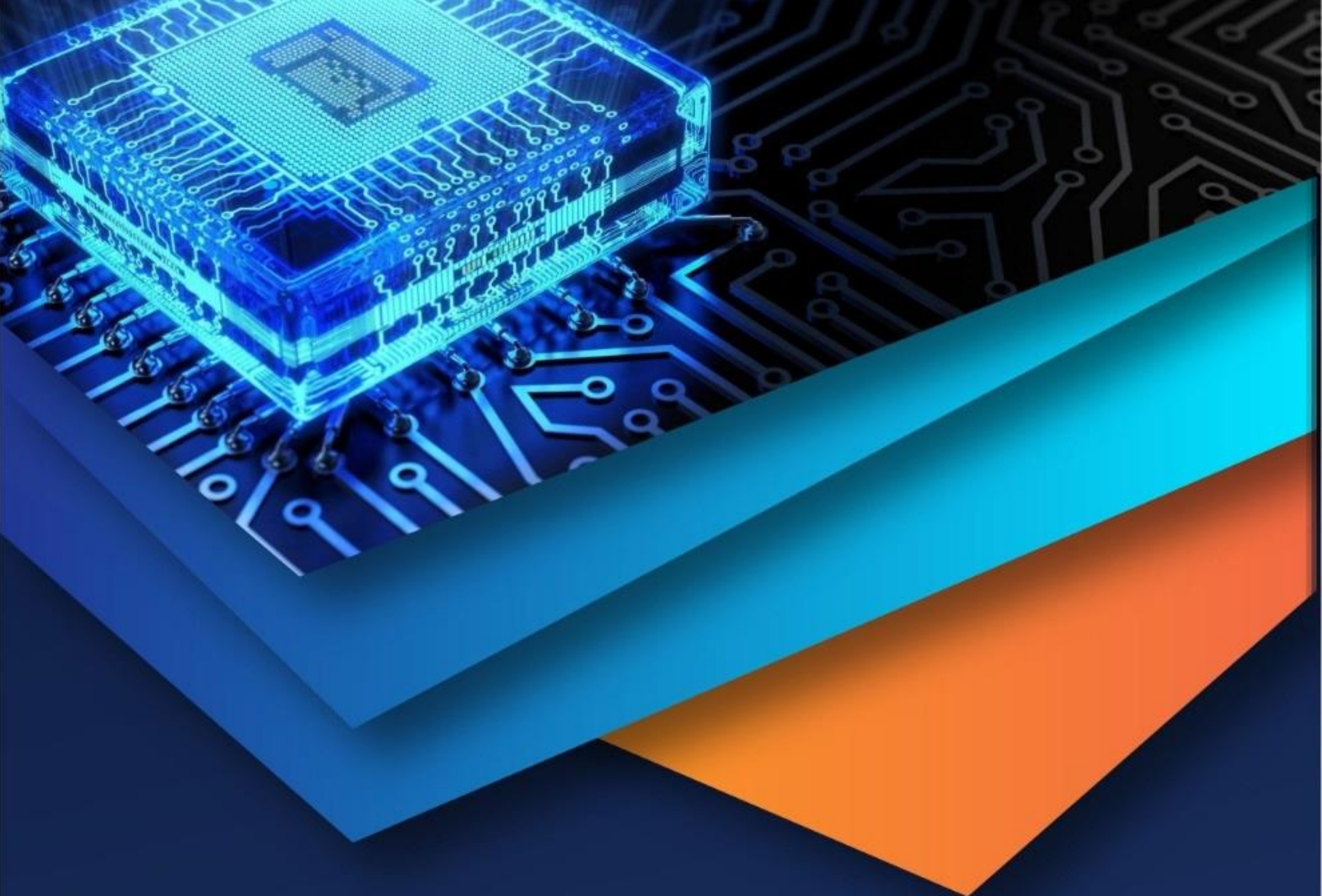

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